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Perceptions of Spanish consumers towards novel lamb burgers enriched with natural antioxidants and healthy fatty acids

Andres Horrillo[1], Carlos Díaz-Caro[2], Eva Crespo-Cebada[1], David Tejerina[3], Francisco Javier Mesías[1]*, Antonio Rodríguez-Ledesma[1], Susana García-Torres[3]

[1]Research Institute on Agricultural Resources, Universidad de Extremadura – Ctra, Badajoz, Spain; [2]Faculty of Business, Finance and Tourism, Universidad de Extremadura, Cáceres, Spain; [3]Meat Quality Area, CICYTEX Junta de Extremadura, Badajoz, Spain

***Corresponding Author:** Francisco Javier Mesías, Research Institute on Agricultural Resources, Universidad de Extremadura – Ctra, Cáceres s/n, 06071 Badajoz, Spain. Email: fjmesias@unex.es

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PAPER

Abstract

This paper explores the perceptions of Spanish consumers on the use of natural antioxidants and healthy fatty acids in novel formulations of lamb burgers to improve their nutritional content and shelf life. Focus groups have been used to obtain information on burger consumption and purchase, as well as on the opinions about the use of natural ingredients. Results highlight the importance consumers place on the presence of ingredients that help improve product quality, and their acceptance to pay a premium. The use of cherry or pecan nut is a valid option, provided that consumer trust is promoted through adequate information policies.

Keywords: focus group; lamb meat; natural ingredients; novel formulation; processed meat

Introduction

In recent years, trends in meat consumption have been changing, both in terms of levels of consumption and type of product, with red and processed meats declining due to consumers' awareness on health and the environment (Godfray *et al*., 2018). In fact, a clear example is the lamb consumption, which has decreased considerably both in Spain and the European Union (Rabadán *et al*., 2020), with significant losses for the production industry. This fact, together with the changes in the lifestyle of the population in the last years—consumers demanding more fast or ready to eat food—has forced the industry to develop strategies in order to diversify their products in a way such that they become more attractive to the consumer, as is the case of burgers. Burgers are extensively consumed and a popular meal worldwide due to its convenience, low cost and pleasant flavour. In Spain alone, the consumption of burgers exceeds 3 million units per week (MAPA, 2018). In spite of the numbers, burgers are perceived as unhealthy food, on account of their association with red meat (Binnie *et al*., 2014), and because of their content of saturated fats and lack of fibre, which relate to the prevalence of cardiovascular disease, colorectal cancer and obesity (Spencer *et al*., 2005).

Also recently some initiatives have attempted to improve these unhealthy features of burgers. Thus, several studies have examined the addition of antioxidants to meat products in order to minimise oxidation processes and to maintain their properties during storage or to improve their health benefits. The addition of some by-products of tomato (García *et al*., 2009), grape and olives (Andrés *et al*., 2017; Sáyago-Ayerdi *et al*., 2009), essential oils (Pateiro *et al*., 2018), cinnamon bark oil (Hussain *et al*., 2021) or even spices such as oregano (Vergara *et al*., 2020) has been analysed. The addition of fruit or vegetable by-products to burgers, in addition to providing

antioxidant compounds, adds dietary fibre to the product, and therefore, Madane *et al*. (2019) considered that they have dual properties.

Lamb meat from the autochthonous breed Merina is considered a traditional product with good sensory attributes and higher n-3 concentration levels (Linares *et al*., 2007, 2008), and its production is associated, to a large extent, to the sustainable use of the *dehesa*[1] ecosystem (Gaspar *et al*., 2008). The addition of natural ingredients, such as cherry (*Prunus avium L.* var. Pico negro) as an important source of antioxidants or pecan nuts (*Carya illinoinensis* (Wangenh), K. Koch, var. Osage) as a source of healthy fat [rich in mono- (MUFA) and poly-unsaturated fatty acids (PUFA)], both also containing dietary fibre, might in principle result in a healthier and an attractive product for the consumer. However, generally, they have a negative attitude towards healthier meat products due to unfamiliarity and perception of overprocessing, although plant-based ingredients together with fat and salt reduction show specific conditions under which consumers' acceptance would be possible (Barone *et al*., 2021). On the other hand, Lang (2020) examined the nature of consumer response to blending plant-based ingredients (mushrooms) to traditional meat-based foods and the individual lifestyle and motivational differences that influence this response.

From the viewpoint of producers and manufacturers, these new products such as lamb burgers with natural ingredients such as cherries and pecan nuts could fill a niche in the market and be totally acceptable both in technological and nutritional terms. Consumers, however, might not share this perception as they tend to be reluctant to try new products and technologies, on account of their concern about the potential risks and the doubts about the possible benefits involved, but also as a sign of neophobia, that is, a common negative reaction to all things new (Frewer *et al*., 2011). This is one of the reasons why the stakeholders would benefit from understanding consumer perceptions towards these burgers with natural ingredients such as cherries and pecan nuts.

Nevertheless, this is not a simple task, as the number of factors affecting consumer perception towards food is numerous, for example, health, food culture and traditions, which make it hard to use traditional quantitative research approaches. Specifically, in the case of mutton, Hastie *et al*. (2022) found that familiarity and previous experience with the product were significant predictors of consumer appreciation and overall taste. Besides, consumers might not be willing—or able—to be totally honest when answering complex questions on their perceptions or attitudes towards certain foods or technologies, as they may be reluctant to share their opinions, unfamiliar with the subject under study or simply lack confidence to answer (Donoghue, 2010; Eldesouky and Mesias, 2014).

Therefore, qualitative research has been considered as a valid approach for this particular research study as it is a flexible and adaptable type of research and is suitable to find out the nature of a problem or identify alternative actions (Guerrero *et al*., 2009; Stewart *et al*., 1994). Given its potential, qualitative research has been broadly applied in the food sector, with applications in the study of attitudes towards food safety (Behrens *et al*., 2010), ready-to-eat foods (Vidal *et al*., 2013) or consumer perception towards imported fruits (Vaca and Mesías, 2014).

Amongst the numerous qualitative research techniques available, we decided to use focus groups as it is one of the most popular methods for the preliminary stages of a research, as is the case of this study (Eldesouky and Mesias, 2014), also being adequate for research studies related to the development and application of new products or services (Horrillo *et al*., 2020). This technique is based on group dynamics with a moderator whose role is to promote discussion by the exchange of opinions amongst the participants and has certain advantages against other more structured research approaches using questionnaires, as it allows and promotes more freedom to speak amongst the participants (Gaspar *et al*., 2016).

Taking into account this context, the purpose of this paper is to explore consumer perceptions on the use of natural ingredients (cherry and pecan nuts) in burgers made of Merina lamb (autochthonous breed from Spain), with the purpose of improving their nutritional properties and preservation. Various topics were analysed, such as burger consumption and purchasing habits, the factors that influence burger purchasing, the influence of origin, species and breed on the burger purchase decision and the opinion on enhanced and processed meat products.

Methodology

Focus groups

A focus group should include 6–12 participants (Malhotra and Birks, 2006) in order to run smoothly, because less than 6 people would make it hard for group dynamics to take place, whilst discussion flow in a group exceeding 12 participants may be hard as it would be difficult to have the opinion of the less talkative, and the moderator may encounter difficulties to conduct the discussions around the topic of research.

[1]The *dehesa* is an agroforestry system located in the SW of the Iberian Peninsula, used for livestock-range farming characterised by its mix of pasture and evergreen oak stands.

It is also recommended for the groups to represent the sociodemographic diversity of the population under study, although on occasions it may be advisable to use homogeneous groups (Horrillo *et al.*, 2020). The venue where the discussion groups are held is also relevant, because an informal and relaxed atmosphere helps participants forget that they are being watched and interviewed (Gaspar *et al.*, 2016).

Taking into account all the above parameters, four focus groups were held for the purpose of this research study between March and July 2020, which were attended by a total of 40 participants (9–12 people per session). These sessions were held in three big cities in the region of Extremadura (Southwestern Spain), to include population diversity. A public relations company was commissioned for the selection of the participants and moderation of the discussions. Participants were selected by convenience sampling, which is a habitual technique in qualitative research (Eldesouky and Mesias, 2014), with the main selection criteria being willingness to participate in the study and to be meat consumers. As the sample was not meant to be representative of the population, due to its size and the qualitative nature of the study, efforts were made to include a variety of people according to the sociodemographic and purchasing characteristics of the participants, which could enrich the discussion. Table 1 shows the breakdown by gender, age and highest level of studies completed by the participants involved in the sessions.

Focus groups development

The sessions began with the explanation of the research project under which the activity was being performed in order to provide some background to the participants. Subsequently, the participants were asked to introduce themselves, as a way to break the ice, and the discussions followed according to the script shown in Table 2, where the moderator would be introducing the topics for discussion and encourage participants to provide their opinions. When the topic proposed by the moderator had been dealt with, he would continue the session by introducing a new topic to discuss.

As shown in Table 2, on conclusion of each session, participants were offered a taste of the lamb burger that was enhanced with cherry (*Prunus avium L.* var. Pico negro) and pecan nuts [*Carya illinoinensis* (Wangenh), K. Koch, var. Osage], following which they were asked to provide their feedbacks.

The research was conducted in compliance with the University of Extremadura Bioethics and Biosecurity Committee regulations regarding studies with human participants. All participants provided their written informed consents after reading an informative document with details on the purposes of the study, the methods used for data collection, the audio recording and data confidentiality. The sessions were video- and audio-recorded for subsequent analysis. Each session lasted an average of approximately 120 min in total. On conclusion of each session, the attendees were given a gift that valued 5–10 euros as a thank you for their help.

Data analysis

The video and audio recordings of the four sessions were transcribed and anonymised for subsequent analysis. The

Table 1. Gender, age and highest level of studies completed.

Variable	%
Gender	
Women	57.5
Men	42.5
Age	
<30 years old	15.0
31–44 years old	25.0
45–65 years old	50.0
>66 years old	10.0
Level of study	
Primary education	22.5
Secondary education	20.0
University studies	57.5

Table 2. Script followed in the focus groups.

Processed meat products
Frequency of consumption of burgers and settings
Types of burgers consumed
Types of packaging
Purchasing factors
Effects of origin, species and breed on the purchase decision
Types of burgers purchased according to animal species and processing method
Importance of species or breed, type of farm production and origin of the meat
Product organoleptic properties
Enhanced meat products
Opinion on natural ingredients or additives
Effects of enhanced burgers on organoleptic properties
Willingness to pay for enhanced products
Tasting session and discussion about lamb burgers enhanced with cherry (*Prunus avium L.* var. Pico negro) and pecan nuts [*Carya illinoinensis* (Wangenh) K. Koch, var. Osage]

transcriptions of each session were compared and analysed in order to find which aspects were relevant in all the sessions.

The analysis of the data collected was performed using content analysis (Stewart and Shamsasani, 2014). Content analysis is a research technique that seeks to obtain valid and replicable inferences from texts in order to reduce the amount of input materials (Flick, 2009). For the purposes of this paper, the information was initially processed and organised by common topics, grouping under each topic all the ideas or concepts that were mentioned repeatedly during all the sessions. All the terms and their meanings were taken into account for the analysis, with the comments provided for each question being later analysed with the purpose of identifying similarities and differences. With the purpose of improving the robustness of the results, analyst triangulation was applied, a procedure frequently used in qualitative research (Eldesouky *et al*., 2015; Horrillo *et al*., 2020). Finally, the frequency of mention of each category or concept was calculated as a way of showing its relative importance, as those items that generally receive the highest frequency of mention are assumed to be the most relevant ones. Figure 1 summarises the methodology carried out in this research.

Preparation of samples

Burgers were made with the meat obtained from legs and breasts of Merino lambs raised under the Protected Geographical Indication (PGI) 'Merino Lamb.' Lamb legs and breasts were deboned, chopped, and the meat was minced. The minced meat was distributed into two batches. Each batch was mixed in an automatic mixer (Mainca PM70, Spain), for 5 min, adding salt (1% w/w) and white ground pepper (0.2%). The ingredients were added to each batch and mixed: freeze-dried cherry (6%) and pecan nuts (10%). Burgers were prepared (100 g/10 cm diameter) using a conventional burger maker (Mainca MH/MA, Spain).

Burgers were packaged using vacuum skin film, which preserves and extends shelf life compared to other types of packaging (Kameník *et al*., 2014). For packaging purposes, a packaging machine (Ulma® Smart 300) was used, and the samples were packaged in trays (P 1520SW30E, Faerchs), made of co-extruded polyamide or polyethylene (PP/EVOH/PE EOST) and wrapped in film (VSTM, Cryovac®). Burgers were then frozen until the tasting test was carried out during the focus group.

Quality trait analysis

In order to understand the differences of the nutritive and antioxidant content in the final quality of the two products (lamb burgers with cherries or pecan nuts natural ingredients) versus the control lamb burgers (Table 3), the nutritive and antioxidant compositions were determined, which showed that the addition of pecans improved the natural antioxidants content (α- and γ -tocopherols), MUFA and PUFA and fibre, with respect to the cherry lamb burger, which was richer

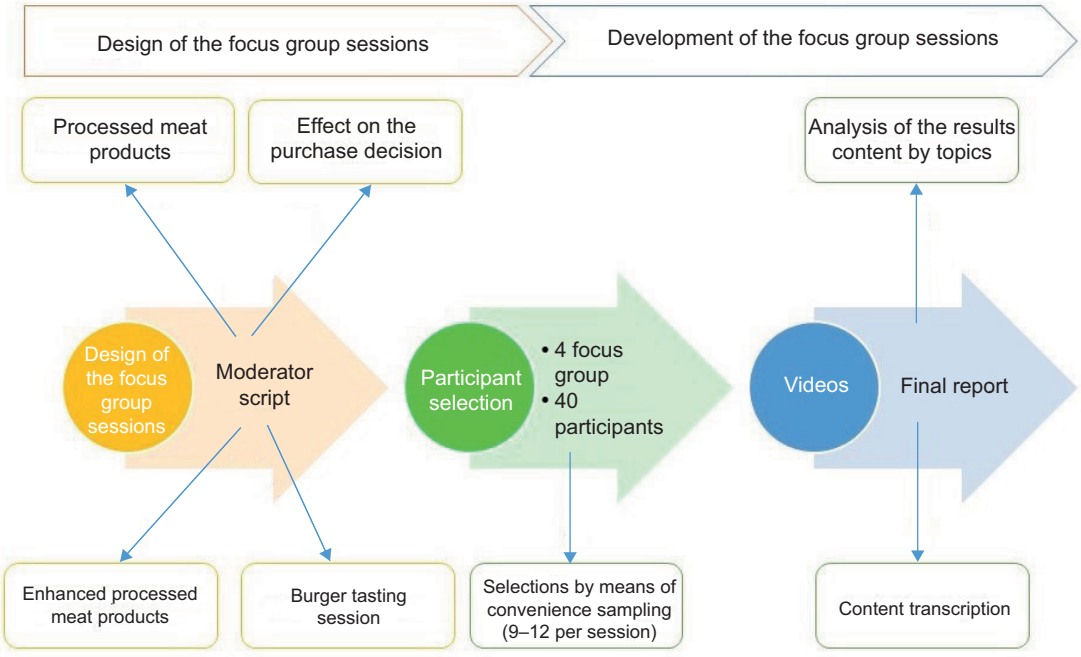

Figure 1. Methodological procedure followed in the research.

in phenols content and total antioxidant activity. The moisture, protein and ash content were determined according to AOAC standards (2003). The fat content was determined using the method developed by Folch *et al*. (1957).

Tocopherols (α and γ) were quantified according to the method proposed by Cayuela *et al*. (2003). The total phenolic compound was determined according to Singleton and Rossi (1965), and the total antioxidant activity was determined following the method described by Cano *et al*. (1998). Phenol content was quantified using the method described by Singleton and Rossi (1965).

The fatty acid profile was determined according to Ortiz *et al*. (2020a), and the indexes to measure the nutritional quality of the fatty acids were estimated: saturated fatty acids (SFA), MUFA, PUFA, n-6/n-3 and the atherogenic [% AI = 100 × (C12:0 + 4 × C14:0 + C16:0)/(MUFA+ n – 3 PUFA + n – 6 PUFA)] and thrombogenic indexes {% TI = 100 × (C14:0 + C16:0 + C18:0)/[(0.5 × MUFA + 0.5 × n – 3 PUFA + 3 × n – 6 PUFA + (n – 3 PUFA/n – 6 PUFA)]} (Rios-Mera *et al*., 2021).

Tasting session

Prior to the tasting process, the participants were informed about the products to be tasted—type of product, origin of raw material, as well as information about the ingredients of the burgers—and they were warned about possible allergens in order to rule out potential participants. They were also showed fresh and skin-packed burgers, as found at the point of sale, with the aim of further leading the discussion to the type of packaging.

Burgers were thawed for 24 h under refrigeration (4 ± 1°C) before each focus group session. During the development of each session, burgers were cooked in an adjoining room on two electric grills (one for burger with cherries and other for burger with pecan nuts) until an internal cooking temperature of 72–75°C was achieved, measured using a digital food thermometer. Cooked burgers were cut into four pieces and placed on different identified trays according to the type of burgers, and were presented at the same time to the participants. Finally, each participant tasted a piece of each type of burger, and the debate continued under the guidance of the moderator.

Table 3. Nutritive, antioxidant and fatty acids profiles of lamb burgers with natural ingredients added.

Lamb burgers (n = 8)	With cherry	With pecan nut	Control	
Nutritional composition (mean ± standard deviation)				
Protein content (%)	15.08 ± 2.71^{b}	17.63 ± 0.86^{a}	16.64 ± 1.27^{a,b}	*
Fat content (%)	12.59 ± 1.03^{b}	16.26 ± 0.46^{a}	14.68 ± 2.50^{a}	***
Moisture (%)	62.07 ± 2.78^{a}	57.08 ± 1.24^{b}	62.24 ± 2.77^{a}	***
Ash content (%)	3.92 ± 0.38^{a,b}	3.61 ± 0.13^{b}	4.34 ± 0.45^{a}	**
Calorific power (Kcal/g)	6.8 ± 0.02^{c}	7.28 ± 0.24^{a}	6.9 ± 0.03^{b}	***
Dietary fibre (%)	0.04 ± 0.01^{b}	0.52 ± 0.15^{a}	–	***
Nutritional quality of fatty acids indices				
SFA	46.61 ± 0.48^{a}	35.39 ± 1.17^{b}	46.55 ± 0.26^{a}	***
MUFA	49.24 ± 0.47^{b}	55.41 ± 0.67^{a}	49.50 ± 0.27^{b}	***
PUFA	4.15 ± 0.18^{b}	9.20 ± 0.54^{a}	3.94 ± 0.13^{b}	***
n6/n3	0.82 ± 0.43^{b}	12.38 ± 0.56^{a}	8.68 ± 0.45^{b}	***
% AI	0.46 ± 0.02^{b}	0.72 ± 0.01^{a}	0.71 ± 0.02^{a}	***
% TI	0.62 ± 0.04^{b}	1.22 ± 0.01^{a}	1.20 ± 0.03^{a}	***
Antioxidant composition				
α-tocopherol (µg/g)	3.82 ± 1.32	4.57 ± 0.71	4.21 ± 0.80	NS
γ-tocopherol (µg/g)	0.09 ± 0.04^{b}	18.64 ± 2.28^{a}	0.16 ± 0.07^{b}	***
Phenols content (mg of gallic acid/g of meat)	3.21 ± 0.20^{a}	1.49 ± 0.14^{b}	0.82 ± 0.07^{c}	***
Total antioxidant activity	2.19 ± 0.22^{a}	0.71 ± 0.05^{b}	0.66 ± 0.04^{b}	***

AI, atherogenic index; MUFA, sum of monounsaturated fatty acids; PUFA, sum of polyunsaturated fatty acid; TI, thrombogenic index; SFA, sum of saturated fatty acids. NS, not significant; $P > 0.05$; *$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$.
a, b, c, different letters in the same row indicate significant differences for different burger formulations (with cherry, with pecan nuts and control) according to Tukey's HSD test.

Results

Processed meat products

Table 4 shows the results obtained from the opinions of the consumers on the frequency of consumption and the commercial format of the burgers.

The most commented categories were 'Types of burgers consumed' (35%) and 'Purchasing factors' (23%). More specifically, there were a large number of comments regarding the types of burgers consumed, with comments relating to home-made burgers consumption obtaining 9% of the responses, followed by 'difference between home-made and industrially made burgers' receiving 7% of the responses. Format and origin are the least frequent comments together with 'easy to cook' and 'processed meat does not help make sales.'

Table 4. Frequency of consumption and commercial formats of burgers (% of mention by the participants).

Category	Subcategory	% mention
Burger frequency of consumption	Not habitually consumed	9
	Consumed by young people	9
Types of burgers consumed	Need of easy-to-cook food	4
	The name 'processed meat' does not help sales	4
	Difference between home-made and industrially made burgers	7
	Home-made consumers burgers (healthier option and trying to make them in different ways)	9
	Need to highlight that burger are natural products	4
	Not used to these lamb formats, but to more traditional ones (chop, leg)	4
	The burger format may lead to more sales of lamb, as it is more popular with younger people	3
Setting	Home consumption	6
	Restaurant consumption	4
Packaging type	Aware of skin packaging	3
	Unaware of skin packaging	8
	Disliked the plastic packaging presented	4
Purchasing factors	Price is a determinant for purchase	9
	Occasional consumption of lamb burgers as opposed to other types of burgers	2
	Usually purchased packaged burgers	1
	Usually purchased butcher's burgers (or minced meat to make burgers)	11

Another aspect that raised many comments was price, which is considered as one of the most relevant factors in the purchase decision of consumers (9%), together with comments stating that participants bought minced meat to make burgers at the butcher's shop (11%).

In the same way, the type of packaging is an aspect that is highly mentioned, mainly in terms of lack of awareness of the skin packaging they were presented in, as well as a dislike for the plastic packaging they are presented with.

And finally, with regard to the frequency of consumption, participants appeared to state that they did not usually eat burgers, and they believed that the population that mostly ate them was young people.

Effects of origin, species and breed on the purchase decision

Table 5 displays the mentions made by the participants relating to the effects of origin, species and breed on the burger purchase decision.

Table 5. Effects of origin, species and breed on the burger purchase decision (% of mention by the participants).

Category	Subcategory	% mention
Type of burger purchased	Distinction between an industrial- or home-made burger	1
	Pork burger	3
	Beef burger	15
	There are no lamb or goat meat products	1
	Chicken burgers	6
	Mixed meat burger	6
Importance of the species or breed	They look at the species before they buy	20
	They do look at the breed before they buy	8
	They do not look at the breed before they buy	5
Organoleptic properties of the product	The organoleptic properties of lamb are very particular	5
	Tasting meats of other species in order to accept their consumption	3
Place of origin	They look at the place of origin of the meat	11
	They do not look at the place of origin of the meat	5
	Greater preference if the burger is made with meat from Extremadura	6
Type of farming production	They look at the ways lambs are produced	4

As shown in Table 5, the comment that received most mentions (20%) referred to consumers who take into account the species before they buy the meat. Following this comment was the mention relating to the purchase of beef burgers, although this category included a vast variety of answers from the participants, from the purchase of single meat–type burgers to mixed meat–type burgers.

The category 'Organoleptic properties of the product' received less variety of comments, probably due to the participants' lack of awareness. The category 'Place of origin' was mentioned in a relevant number of times, which shows how important this factor is in the purchase decision, with a greater number of participants looking at the place of origin of the meat during purchase. Finally, the type of production and, specifically, the lamb production process were mentioned in 4% of the comments.

Enhanced processed meat products

Table 6 shows the opinion of participants on their awareness and willingness to pay for enhanced processed meat products.

The participants stated their awareness of enhanced processed meat products with a frequency of mention above 27%. They associated these types of products mainly with burgers and sausages. Generally speaking, most of the participants recognised that they do not pay attention to the origin of the ingredients of the enhanced products they buy or consume (23%). Additionally, the results also reveal some degree of uncertainty about them, with some participants associating products with additives with unhealthy food. The comments from Table 6 also reveal concerns about misleading advertising (2%), as little is explained about the use of ingredients in food (2%) and the preference for natural ingredients (4%).

Regarding the organoleptic properties, the participants explained that on many occasions the enhancement of these products can mask the original flavour of the food. Such techniques may also bring certain benefits by improving the flavour, taste, smell, aroma, texture and external appearance—mainly colour—when the final purpose is to increase product sales. On the other hand, in terms of the potential health benefits of the enhanced meat products, the participants only stated that its consumption is motivated by taste rather than the health benefits they provide.

One of the most discussed categories amongst participants was the selling price of the enhanced product, with comments such as:

> *these products require a more complex process, and for this reason they must have a higher price*: male, 35 years old, butcher;
>
> *if they are better in quality, a price premium is to be expected*: male, 38 hospitality business;
>
> *lamb meat has always been more expensive than pork or chicken and is to be expected that their products will be more expensive too*: male, 65 years old, retired.

Table 6. Awareness and willingness to pay for enhanced processed meat products (% of mentions by participants).

Category	Subcategory	% mention
Awareness	Awareness of the product	27
Ingredients	Do not look at the origin of the ingredients	23
	Do look at the origin of the ingredients	5
	Prefer natural ingredients	4
	Necessary explanation of the ingredients	2
	Not healthy (reluctant to term 'additive')	10
	There is misleading publicity on additives	2
Organoleptic and healthy improvements	Vary the original flavour of the product	2
	Consumption motivated by taste and not by the benefits for health	6
	They improve the properties of the product	2
Settings	Recreational consumption, outside the home	6
Willingness to pay	Yes, they are willing to pay for additive-enhanced products	6
	Yes, they are willing to pay for products without additives	2
	More information on product additives would improve sales	2
	Do not understand the price premium of products with additives (in Extremadura)	1

Six percent of the participants were willing to pay a price premium for these types of products, whereas others preferred to rather pay for products without additives. Another mention was the addition of more information about the additives and ingredients, which would increase customer trust and market sales. The participants also preferred to consume the product outside their homes, in restaurants and bars, during their leisure time.

Lamb burger enhanced with cherry and pecan nut: commercialisation, sale and acceptance

Table 7 shows the findings from the discussion about lamb burgers enhanced with natural ingredients (Pecan

Table 7. Participant opinions on the specific case of the lamb burger enhanced with cherry and pecan nut (% of mentions by participants).

Category	Subcategory	% mention
Opinion on enhanced lamb burgers	Reluctance towards lamb (it is expensive, it has bad press—cholesterol—and strong flavour)	9
	Differences between the flavour of meat from grazing sheep and from sheep fed on fodder	3
	Young people should eat more lamb	3
	Overcome the cultural barrier of lamb consumption	3
Natural ingredients	Differentiate whether the added product (enhanced) improves preservation of the meat or improves the nutritional values of burgers	1
	The fact that the ingredients come from products or brands with recognition in the area is valued	4
Potential place of purchase and/ or promotion	Food fairs	1
	Media	3
	Gourmet product (+quality)	21
	It is difficult to find lamb for mincing in the butcher's	3
	Not available on the shelves of large supermarkets	16
	Tasting counters in large supermarkets	4
	Butchers'	3
	Specialist restaurants	14
	Specialised shops	18
Price	Change of the format of the suckling lamb to a larger one in order to obtain more meat from the carcass	34
	Reduce production costs	1

nuts and cherries). As the table shows, the attendees mention that there is a certain degree of reluctance in the population towards consumption of lamb. This meat is seen to have a strong flavour that young consumers are not used to. In addition to this, it has received a negative press for being a red meat. It has been classified as one of the types of meat that is responsible for increasing blood cholesterol levels. Nevertheless, it has also received some positive comments by some attendees, who considered it to be a healthy meat produced in a natural environment (especially in pasture-based systems).

In terms of the place where these products should be promoted and/or commercialised, the participants clearly agreed that they should be sold in specialist restaurants (14%) and specialist shops (18%), and not in supermarkets (16%). They mentioned that they saw this product as a gourmet option (21%) and not as an everyday product that is easy to find in butchers' or supermarkets.

And finally, Figure 2 shows the consumer perceptions following a tasting session of lamb burgers enhanced with cherry or pecan nuts. A comment was made by all the participants relating to the nice flavour that the added components contributed to the meat. Also, the addition of cherries seemed to have a higher acceptance amongst both participants who liked lamb and those who didn't, in the latter group because it covered the lamb flavour.

In general, these burgers, with the incorporation of cherries or pecan nuts, were highly accepted. This opinion was reinforced by the natural characteristics and the local origin of these natural ingredients. Finally, the participants were willing to pay a price premium for the product, on account of both nutritional and functional improvements.

Discussion

An aspect that is highly valued by the participants in terms of burger consumption is the way in which they are prepared. They especially appreciate that the burger is healthy and made with butcher's meat. This seems to agree with the findings from other consumer evaluation studies with similar methods on traditional food products (Pieniak *et al*., 2013) and also with specific studies carried out on burgers (Arbaiza *et al.*, 2020; McCormick et al. 2003; Viana *et al.,* 2014). In terms of the setting for burger consumption, the participants were more inclined to consume them at home than in restaurants, as is the case with other research studies carried out on burgers (Atalaya *et al*., 2018). Another aspect that was frequently mentioned is the price, which is seen as one of the most relevant aspects by participants, and this is in line with other papers dealing with food-purchase decisions (Eldesouky *et al*., 2020; Groves, 2001).

In terms of packaging, most participants stated that they were not aware of the skin-pack format. In this sense, some research studies have proven that the type of packaging is usually a relevant attribute in the purchase decision (Heide and Olsen, 2017; Ortiz et al., 2020b; Silayoi and Speece, 2007), and therefore a higher degree of consumer awareness of the benefits of the packaging could improve acceptance of the product (Lindh *et al*., 2013).

Out of the factors affecting the purchase decision, the importance that consumers place on species is high. On the other hand, meat consumption continues to decline

Figure 2. Perceptions obtained following the tasting session of an enhanced burger with cherries or pecans.

in recent years, especially fresh meat, and more specifically lamb in Europe (Mandolesi *et al*., 2020). Although there has been an increase in the consumption of processed meat (MAPA, 2019), with beef products being more popular than lamb. This fact coincides with the number of mentions made about the purchase of beef burgers in comparison to other types of burgers. This trend towards beef meat can be connected to the perception that these are healthier meats (Grunert *et al*., 2004) in comparison to other meats. Origin is another relevant factor in the purchase decision, as some research studies have stated (Rabadán *et al*., 2021; Sama *et al*., 2018). Our findings also show that most participants gave importance on the origin of the lamb meat, in line with the findings obtained by Bernabéu and Tendero (2005) who found that the second most valued attribute for regular lamb consumers was the origin of the product, just after external appearance.

On the other hand, the improvement of the technological properties of enhanced processed meat products is currently a line of research that is in full development (Cózar *et al*., 2018; Câmara *et al.* 2020). In this sense, the prevention of oxidation of the proteins and lipids becomes essential for the preservation of the shelf life of meat products, with additives becoming necessary to attain this.

The opinions revealed in this study specifically showed a general dislike of additives in a wide variety of processed products. Many participants did not distinguish between artificial and natural additives and agreed that the 'products with additives' tend to be less healthy. Nevertheless, they also gave positive scores to natural ingredients and to having an appropriate explanation of the added product on the label. In parallel, various studies on consumer preferences and behaviour have also been conducted for these products (Guerrero *et al*., 2017; Viana *et al*., 2014). Specifically, Polizer Rocha *et al*. (2018) assessed consumer perceptions of Frankfurt sausages with various attributes, with the findings being in line with this study, where these enhanced processed products are habitual in consumers' diets. Also, Pires *et al*. (2019) assessed the consumer perceptions of mortadella with reduced sodium content and/or enhanced with omega-3, focusing on the health aspect of the products as a solid reason for consumers' purchase behaviour.

With regards to the willingness to pay a price premium for enhanced processed products, there was generally a greater percentage of positive comments, although this trend was opposed by other mentions that were made in relation to the willingness to pay for artificial additive-free products. These results are in line with the research studies such as that of Martínez Michel *et al.* (2011) on consumer preference for chicken meat. In that study, the consumers preferred to choose additive-free and added flavour–free natural products, although certain communities (young people) were willing to pay for chicken with differentiated added properties (light, low in sodium, etc.).

The importance of the label in the commercialisation of meat products is a relevant topic under discussion (Eldesouky *et al*., 2020; Janssen *et al*., 2016; Picardy *et al*.,

2020; Van Loo *et al*., 2014), with a variety of results being found. In this study, the participants mentioned the need to have more information of the specific ingredients on the label, a fact that would reassure consumers. In the eyes of the buyer, the label is a sign of quality as much as meat colour at the time of purchase (Rabadán *et al*., 2020), even for consumers who are familiar with the product (Grunert *et al*., 2004). These findings are in line with those of Solomando *et al*. (2021), who studied the sensory properties of boiled and dry-cured sausages enhanced with microcapsules of fish oil, and highlighted the effects of the information provided on the label. In this case, such information increased the scores obtained in the tests and questions about the intention of purchase, given that the provision of precise nutritional data on the label and statements on the nutritional values and health properties are information that is easily understood by consumers without the need to have precise knowledge on nutrition (Feunekes *et al*., 2008; van Kleef *et al*., 2008).

Lamb consumption amongst the Spanish population is low in comparison with other types of meat (MAPA, 2019). This meat is traditionally associated with special occasions or festivities (Blasco, 2017) and its consumption is particularly low amongst the youth population (Bernabéu and Tendero, 2005). Lamb is not a popular meat for many reasons, amongst which the main reasons being strong flavour and little presence in the home diet (Alcalde *et al*., 2012). The focus group participants highlighted, aside from price, the fact that lamb recipes are much more complex than recipes made with other meats such as chicken and pork. The latter meats are currently the most popular (Alcalde *et al*., 2012).

The attendees of the sessions did not disapprove of the presence of natural ingredients in the meat, but what they found more interesting is the fact that such ingredient could add benefits to lamb, which is considered to be a positive aspect from the point of view of quality, health or meat preservation, and always under the premise of using healthy products (Fernandes *et al*., 2017; Florowski *et al*., 2019). In this context, it seems possible to develop burgers enhanced with vegetal ingredients with the purpose of making them healthier. Urruzola *et al*., (2018) concluded that there is a market niche for the introduction of a burger enhanced with vegetable ingredients in its formulation and that it would be recommendable for these properties to appear on the label so that potential buyers can be aware of the benefits it has (Bernués *et al*., 2003).

Fat and fatty acids profile of meat are factors that are responsible for the flavour of the meat, which is mainly determined by the animal species and their feeding habits (Erasmus *et al*., 2016). Some attendees mentioned that the 'peculiar' flavour of lamb can attract certain burger consumers who seek different aromas for occasional meals, or look for products of specific breeds (Linares *et al*., 2012).

Some participants also mentioned the difficulty in finding minced lamb meat in butchers' shops to make homemade burgers. The main reason is the small lamb formats slaughtered in Spain, where the usual carcasses being produced are below 11–12 kg in weight (Bernabéu and Tendero, 2005; Font *et al*., 2006). These carcasses provide very low number of trimmings and low-quality meat that could be used as by-products to make minced meat. The deboning process is more demanding compared to beef, and this would increase the price of the final product. Cózar and Vergara (2018) made lamb burgers from the Manchego breed using high and low commercially valued cuts such as leg, neck and flank, although they did not study the impact of the deboning process on the final price.

As mentioned above, label information about the properties and origin of the product has been described as essential for the marketing of meat products (Bernués *et al*., 2003; Font*et al*., 2011). For new food products it is necessary to implement an adequate technological process, providing a balance between the market needs (reduced oxidation, packaging that can extend the shelf life, etc.) and the adequate additive or ingredient concentrations in order to prevent a change in the flavour of the product (Cózar *et al*., 2018). However, it would also be necessary to implement an adequate promotion policy and diversify the range of lamb meat products on the markets (Linares *et al*., 2020). Nevertheless, promoting this product through advertising may not be sufficient to attract potential buyers. A label marking that 'cherry' has been used, for example, may suggest that the final product has acquired some sweet aromas or flavours that may not be accepted by the consumers, and this may compromise the purchase. It would therefore be necessary to carefully assess how the information on the label needs to be provided.

Conclusions

Meat consumers are clearly interested in eating quality and healthy meats. This is especially the case with meats, such as lamb, which are perceived as 'red meat' and therefore as unhealthy. However, when meat is consumed in the form of burgers, this makes it possible to add certain products that could improve the nutritional profile of the meat. This makes it necessary to know consumers' views in order to promote new products enriched with natural ingredients (cherry and pecans) that could fill a niche in the lamb market. The use of focus groups has

proved to be an interesting tool for this purpose, due to their exploratory and unstructured nature.

In this study, two of the most relevant aspects for the participants were the origin of the meat and the use of quality natural ingredients from the region. However, this information should be clearly displayed on the label of the meat products so that consumers can have it available at the time of purchase. However, consumer knowledge and understanding of food labelling should also be studied in order to effectively design these tools.

Thus, these burgers could become an attractive option for a segment of the population that seeks to consume more natural and healthy foods, because the participants also stated that they would be willing to pay a premium for improved lamb burgers compared to traditional ones. However, the fact that the focus groups indicated that burgers are mostly consumed at home raises the issue of addressing the promotion of these products primarily to retailers rather than to restaurants and burger bars.

The addition of cherries or pecan nuts to burgers, natural ingredients perceived by consumers as healthy and nutritious, can contribute to discovering new market niches that allow the development of the lamb meat industry. In addition, it can help promote the consumption of this type of meat, emphasising the value of its origin and label information to build loyalty amongst new consumers.

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